INVESTIGATOR'S ANNUAL REPORT

National Park Service

All or some of the information provided may be available to the public

Reporting Year: 1995	**Park:** Shenandoah NP
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No co-investigators

Permit#:
SHEN1995ANPF

Park-assigned Study Id. #:
unknown

Project Title:
Variation In The Aggressive Behavior And Testosterone Levels Of The Red-Backed Salamander

Permit Start Date: Jan 01, 1998	**Permit Expiration Date** Jan 01, 1998
Study Start Date: Jan 01, 1993	**Study End Date** Jan 01, 1996

Study Status:
Completed

Activity Type:
Other

Subject/Discipline:
Ecology (Aquatic, Marine, Terrestrial)

Objectives:

The objective of this study was to examine environmental factors and evolutionary processes that influence variation in the territorial behavior (aggression and submission) of the red-backed salamander, Plethodon cinereus. I studied variation in agonistic behavior within populations across seasons (where environmental conditions change) and among populations at different geographic localities (where the populations differed based on historical factors, such as genetic relatedness, and current factors, such as habitat type). Another purpose of this study was to investigate a potential physiological mechanism associated with variation in aggressive behavior: hormone levels (testosterone and corticosterone). This study has important implications in that Plethodon cinereus is competitively superior to the endangered Shenandoah salamander, Plethodon shenandoah. Thus, factors that influence aggression in the former species are of particular interest in the preservation of the latter species.

Findings and Status:

I investigated variation in the agonistic behavior of territorial salamanders within populations over seasons and among populations over a large geographic area. Over seasons, I found that the agonistic behavior of individuals varied for two populations (one from Hawksbill Gap in SNP and one from Mountain Lake Biological Station, Virginia), with individuals exhibiting more aggression during the summer months. I attribute this variation to the increased payoffs associated with territory ownership during the warmer months, when better territories (e.g., larger territories) provide greater protection from extreme temperatures than do smaller territories. Also, these two populations differed in that individuals from Hawksbill Gap were more aggressive than those from Mountain Lake Biological Station, both in aggressive displays and in biting. This increased aggression may be the result of the high level of interspecific competition that occurs at Hawksbill Gap between individuals of Plethodon cinereus and Plethodon shenandoah. In addition, there is variation in the proportion of tail loss that occurs in individuals across seasons. The greatest proportion of tail loss occurs in the spring (approximately 60% of the population from Hawksbill Gap exhibits some amount of tail loss during this season). This tail loss, most probably the result of predation, has serious implications for the ability of the salamanders to defend territories (tail loss reduces the ability of individuals to defend territories based on my data from Mountain Lake Biological Station). I also found geographic variation in agonistic behavior among eight populations (including two from SNP at Hawksbill Gap and on Skyline Drive at mile marker 62.5). These differences in behavior appear to be the result of historical (genetic) variation among populations, environmental differences associated with high and low elevations, and intrinsic differences among populations. The behavior of individuals from the two populations from SNP were similar, showing high levels of aggression in laboratory contests, compared to

other populations from a different genetic group.

For this study, were one or more specimens collected and removed from the park but not destroyed during analyses?

No

Funding provided this reporting year by NPS:	**Funding provided this reporting year by other sources:**
0	0

Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college

Full name of college or university:	**Annual funding provided by NPS to university or college this reporting year:**
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